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PENSOFT

First records of freshwater fish species in Colombia: extending the distribution of Amazonian and Orinoco fish species

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Abstract

Based on a rigorous analysis of fish collections of the Instituto Amazónico de Investigaciones Científicas (Sinchi) and new collections by us, we report new Colombian records and geographical range extensions for freshwater fish species. The new occurrences include representatives of four taxonomic orders, eight families, and 13 genera. Our findings expand the geographic ranges of fish species within the Amazon and Orinoco basins and include species reported from Colombia for the first time. This information is fundamental for completion of species inventories, as well as analyses of freshwater fish diversity patterns at macroecological scales. In addition, our data provide useful information for the formulation of strategies for the conservation, management, and sustainable use of biodiversity.

Keywords

Cis-Andean, freshwater ichthyofauna, geographical distribution, Neotropics, range extensions.

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Introduction

Scientific reference collections are important tools for biodiversity inventories (Schindel and Cook 2018; Watanabe 2019). They provide information used by different specialists across various disciplines including ecology, biogeography, taxonomy, and systematics (Humboldt 2000; Lomolino et al. 2010; DoNascimiento et al. 2017). The role of scientific collections in systematics and taxonomy is fundamental for species descriptions, assessments of evolutionary relationships, and as a comparative model for biodiversity (Papavero 1999; Seberg et al. 2003). Scientific collections not only provide recent data, but also historical information dating back hundreds of years (Chapman and Busby 1994). This information helps to better understand geographical ranges of organisms and provides a basis for the formulation of strategies for the conservation, management, and sustainable use of biodiversity (Arbeláez-Cortés et al. 2017).

The Colección Ictiológica de la Amazonian Colombiana (CIACOL), is part of the scientific reference collections of the Instituto Amazónico de Investigaciones

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Científicas (Sinchi) at Leticia, Amazonas, Colombia. The Sinchi Institute in Colombia is a scientific governmental agency that promotes the collection and distribution of the biological information of the Colombian Amazon. Just recently, the Aquatic Ecosystems Group of the Sinchi Institute have reinforced interinstitutional partnerships with other research institutes and local agencies to document the highest freshwater fish diversity in the world, the Amazonian ichthyofauna (Lundberg 2001). The CIACOL is composed of specimens collected in the Amazon Biome following Sinchi's definition of hydrographic, biogeographic, and administrative areas. Following the biogeographic classification proposed by Morrone (2006), the Amazon biome in Colombia corresponds to the area covered predominantly by dense moist tropical forest and located within the Amazonian subregion. At present, the CIACOL is composed of almost 4050 lots of fish collected from the Amazon, Putumayo, Caquetá, Apaporis, Vaupés, Inírida, and Guaviare river drainages. The geographical origin of the biological material in collections is important because it highlights areas in which very few ichthyological studies have been done.

Like many taxonomies (Prance 1994), Neotropical ichthyology has become a dynamic field of study in the second half of the last century, with a clear emphasis on systematics and species descriptions (Reis et al. 2016). The humid Neotropics is home to the most diverse ichthyofauna on Earth (Lundberg 2001; Reis et al. 2003; Junk et al. 2007; Leveque et al. 2008; Pimm et al. 2014; Ferraris et al. 2017). The proliferation of surveys in remote unexplored areas, where the aquatic ecosystems of the Amazon hosts high species diversity and endemicity, has increased this number even more. The results of our taxonomic revision expand 16 distribution ranges within the Amazon and Orinoco basins at a drainage scale and include 16 species reported from Colombia for the first time. Our study is based on a rigorous analysis of fish collections at the CIACOL and new collections carried out by us. The results of this study will be useful to a disparate community of researchers interested in the tropical aquatic diversity, including those in the fields of natural history, biogeography, evolutionary biology, systematics, and taxonomy. The species distributions are fundamental not only for completion of species inventories, but also the foundation for analyses at macroecological scale to better understand the processes that influence distribution patterns in highly diverse biotas (Lomolino et al. 2010; Burley et al. 2016).

Natural ecosystems in the Amazon Region are increasingly threatened by habitat loss, overfishing, hydroelectric dams, and climate change (Abell et al. 2008; Castello et al. 2013; Röpke et al. 2017). Understanding the spatial patterns of fish distributions provides essential information for mitigating the effects of anthropogenic changes over fish communities. Detailed knowledge of species distributions at different temporal and spatial scales are essential for conservation, as management plans are often far from completion due to lack of baseline information.

Methods

The new records reported herein were derived from a rigorous analysis of the fish deposited at the CIACOL and recent field work carried out by us. The CIACOL specimens were collected by the Aquatic Ecosystems Group of the Sinchi Institute in various sampling programs under the framework of the project "Conservación y Aprovechamiento Sostenible de la Diversidad Biológica, Socioeconómica y Cultural de la Amazonia Colombiana Amazonas, Caquetá, Putumayo, Guaviare, Vaupés, Guainía". Sinchi is a research institute created in 1993 affiliated to the Ministry of Environment and Sustainable Development, with jurisdiction over the territory of the Colombian Amazon. One of the main functions of the Sinchi is to perform and promote the inventory of Amazon region flora and fauna, to establish collections and data banks, and promote research. The collection of specimens is made under the umbrella of a global research permit issued by the above-mentioned ministry.

Fish catches pertaining specimens from the Amazonian piedmont were done by researchers of the Sinchi Institute using a SAMUS 725M electrofisher. For the remaining areas, the Amazonian lowlands, conventional beach seines of different dimensions (all 5 mm eye mesh) were used by researchers of the Sinchi Institute and others. The specimens were euthanized with clove oil and fixed in 10% formaldehyde solution. Once specimens were fixed, they were transferred to 70% ethanol for taxonomic identification and storage in the CIACOL. We identified the species using descriptions and keys from taxonomic literature on fish from the Amazon and Orinoco basins. We followed the taxonomy and classification system adopted by Fricke et al. (2020). Museum acronyms follow Sabaj (2016). Previously published records were checked using Reis et al. (2003), DoNascimiento et al. (2017), and Fricke et al. (2020). Localities referenced herein were recorded using a GPS with WGS 1984 geodetic datum. To report geographic range extensions, we compared our new records with the nearest occurrences, using hydrological distances and not linear distances, since only the aquatic network serves as corridors for fishes.

Results

New records are reported for freshwater fish species. These include representatives of four taxonomic orders, eight families and 13 genera. Our findings expand distribution ranges within the Amazon and Orinoco basins and include newly recorded species from Colombia.

Order Characiformes
Family Crenuchidae

***Characidium crandellii* Steindachner, 1915**
Figures 1A, 2A

New records. COLOMBIA • 12 adults; Vaupés, Municipality of Mitú, río Paca tributary of the río Vaupés, Cachivera Muela near Acaricuara community; 00.7130°N, 070.2603°W; ca 180 m a.s.l.; 22 Nov. 2012; Astrid Acosta, Jesús Dámaso and Fray León leg.; found at a rapid; voucher CIACOL 961.

Identification. *Characidium crandelli* is distinguished from all remaining *Characidium* species, except *C. declivirostre*, in lacking scales ventrally from the isthmus to the insertion of the pelvic fins (Buckup 1993). Specimens from the rio Teles Pires were identified as *Characidium* aff. *crandelli* using tooth morphology (tricuspid teeth in *C. crandelli* vs unicuspid teeth in *C. declivirostre*) and circumpeduncular scales (10 circumpeduncular scales in *C. crandelli* vs 12 in *C. declivirostre*) (Ohara et al. 2017). We used this same rationale to identify our specimens as *C. crandelli*. A revisionary study of these highly specialized rheophilic fishes is still necessary.

Previously known distribution. Brazil: upper rio Negro basin (Lima et al. 2005), rio Madeira basin (Flausino-Junior et al. 2016), and Rio Tapajós basin (Ohara et al. 2017), all state of Amazonas. Type locality: rio Miang and rio Branco, Brazil.

Remarks. The species is broadly distributed in rapids throughout the Amazon Basin. This species was already recorded from Colombia by GBIF (https://www.gbif.org/occurrence/search?country=CO&taxon_key=2352371); however, this is the first time that it is reported by a published paper.

Order Characiformes
Family Anostomidae

***Leporinus altipinnis* Borodin, 1829**
Figures 1B, 2B

New records. COLOMBIA • 1 adult; Guainía, Municipality of Inírida, río Inírida, laguna Brujas; 03.4649°N, 067.9555°W; ca 80 m a.s.l.; 10 Dec. 2014; Jhonatan Quiñonez and Marcela Nuñez leg.; found in a blackwater lake; voucher CIACOL 1520.

Identification. *Leporinus altipinnis* is unique among its congeners in possessing 13 or 14 vertical bars in adult (>200 mm SL) specimens. The remaining *Leporinus* species present vertical at most nine or 10 bars on the body

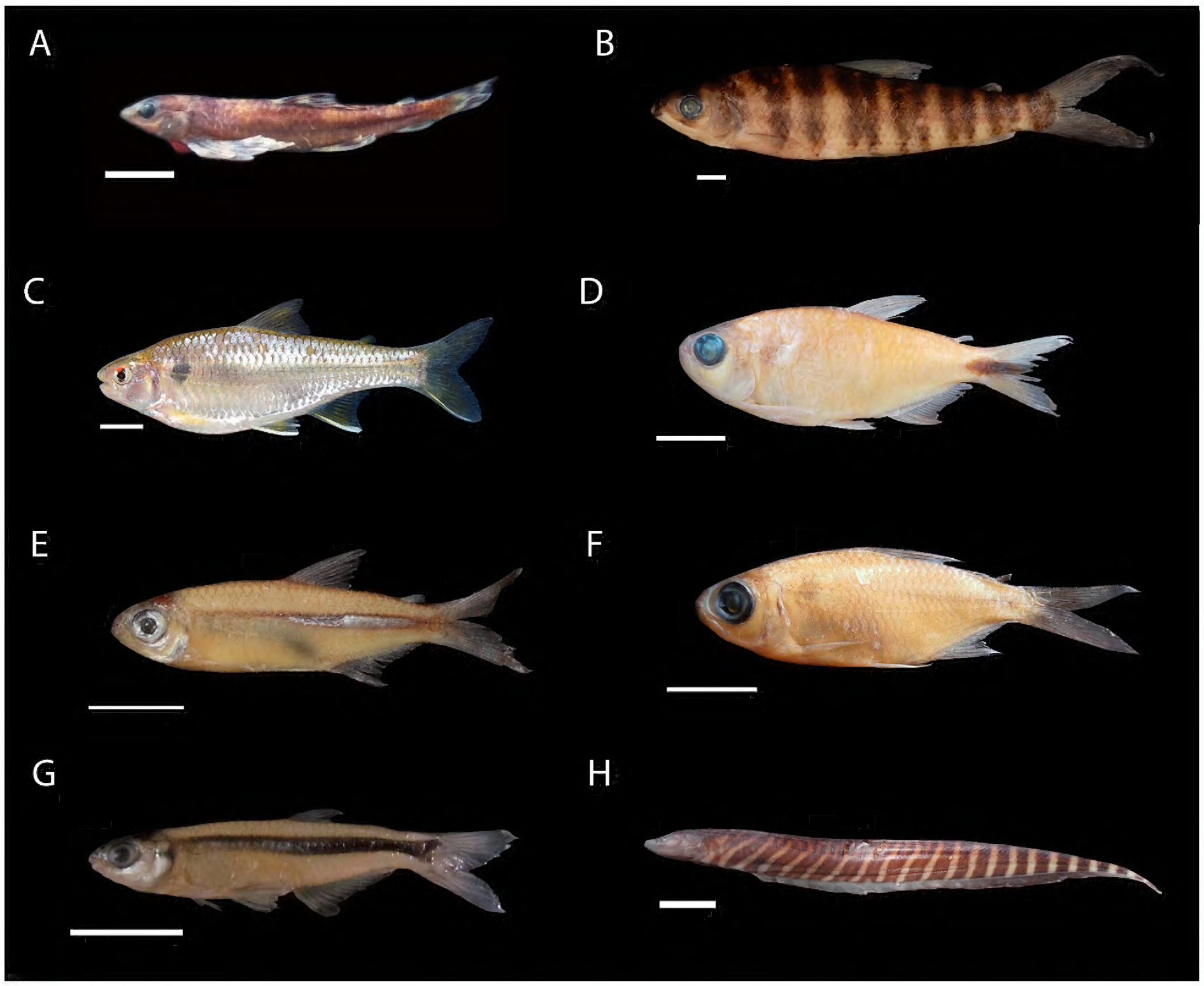

Figure 1. Characiformes and Gymnotiformes. **A.** *Characidium crandellii*. **B.** *Leporinus altipinnis*. **C.** *Creagrutus gyrospilus*. **D.** *Moenkhausia diktyota*. **E.** *M. gracilima*. **F.** *M. lata*. **G.** *Scopaeocharax rhinodus*. **H.** *Gymnotus tiquie*. Scale bars = 10 mm.

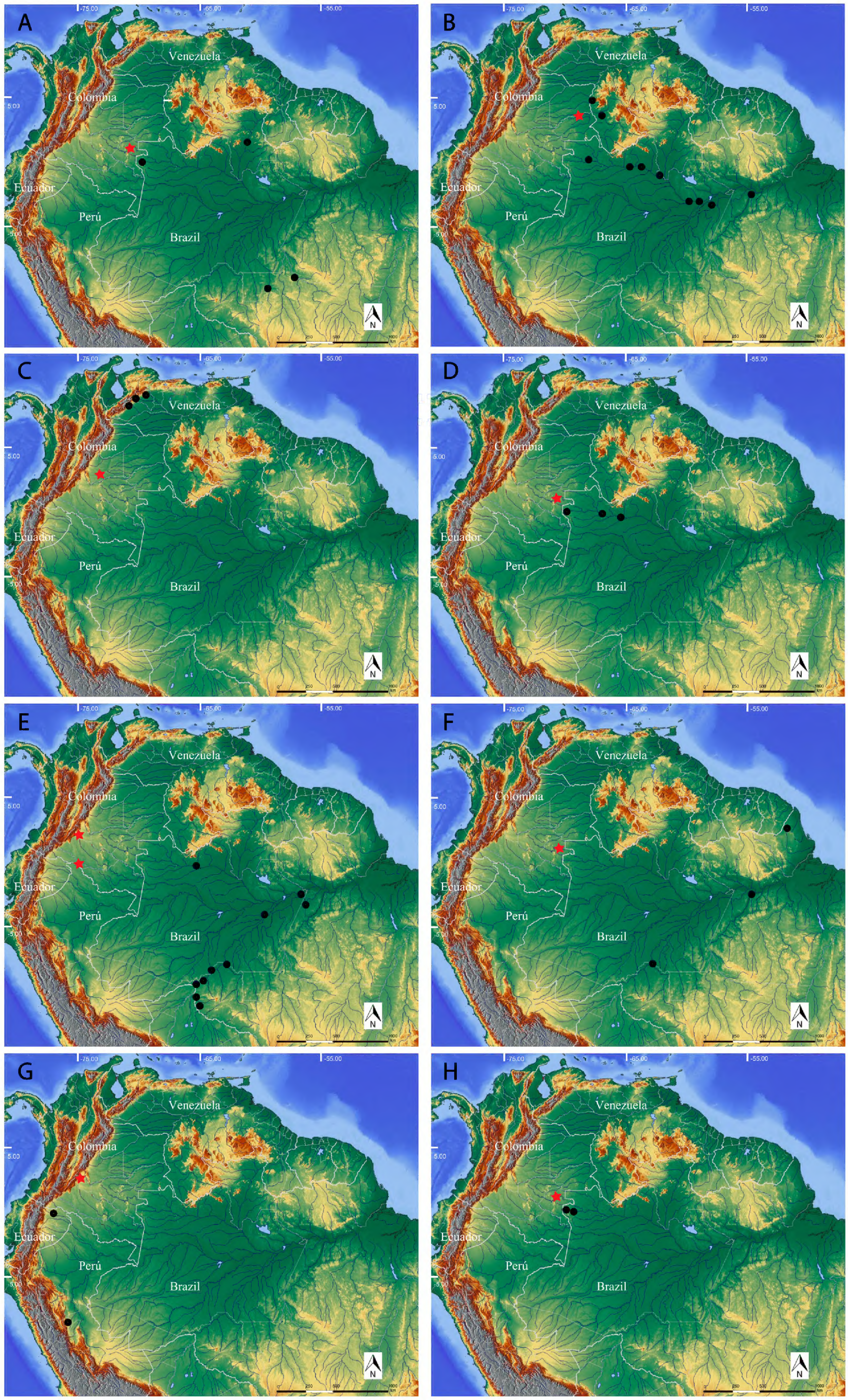

Figure 2. Localities of new records (red stars) and previous records (black cricles) for Characiformes and Gymnotiformes. **A.** *Characidium crandellii*. **B.** *Leporinus altipinnis*. **C.** *Creagrutus gyrospilus*. **D.** *Moenkhausia diktyota*. **E.** *M. gracilima*. **F.** *M. lata*. **G.** *Scopaeocharax rhinodus*. **H.** *Gymnotus tiquie*.

(Britski and Birindelli 2016). Another character distinguishing *L. altipinnis* from its congeners is the pointed lobes of the caudal fin (Britski and Birindelli 2016).

Previously known distribution. In Brazil: rio Arapiuns (tributary of the lower rio Tapajós) and rio Paraconi at FLONA do Pau Rosa, Pará; rio Negro (Britski and Birindelli 2016), Amazonas. In Venezuela: río Orinoco (Britski and Birindelli 2016), Amazonas. Type locality: Jaturana creek or small lake near Barreirinha, Municipality of Parintin, Amazonas, Brazil.

Remarks. The occurrence of *L. altipinnis* in Colombia was expected, as it was recorded for several localities in the Rio Orinoco basin in Venezuela near the border with Colombia (Britski and Birindelli 2016).

Order Characiformes
Family Characidae

***Creagrutus gyrospilus* Vari & Harold, 2001**
Figures 1C, 2C

New records. COLOMBIA • 3 adults; Guaviare, Municipality of San José del Guaviare, caño La Tigrera; 02.2619°N, 073.1224°W; ca 220 m a.s.l.; 25 Oct. 2011; Francisco Villa leg.; found in a small terra firme stream; voucher CZUT-IC 7215.

Identification. *Creagrutus gyrospilus* is identified by the following combination of characters: broad premaxillary with teeth arranged as the first teeth of the primary series, more common pattern for the genus (Vari and Harold 2001), a rounded humeral blotch, and several other morphometric and meristic features (see Vari and Harold 2001).

Previously known distribution. Venezuela: western Orinoco river basin (Vari and Harold 2001). Type locality: río Saguáz, río Guanare-Apure drainage, bridge near park on road to Chabasquén, state of Portuguesa, Venezuela.

Remarks. *Creagrutus gyrospilus* was previously reported in western Orinoco river basin in Venezuela but was not reported in any of its tributaries in Colombia (Vari and Harold 2001). This species was already recorded from Colombia by GBIF (https://www.gbif.org/occurrence/search?q=Creagrutus%20gyrospilus&country=CO&advanced=1); however, this is the first time that it is reported by a published paper.

Order Characiformes
Family Characidae

***Moenkhausia diktyota* Lima & Toledo-Piza, 2001**
Figures 1D, 2D

New records. COLOMBIA • 1 adult; Vaupés, Municipality of Mitú, caño Yi, near the Santa Rosalía community; 01.0545°N, 070.2998°W; ca 200 m a.s.l.; 29 Apr. 2013; Juan Bogotá leg.; found in a sandy small terra firme stream; voucher CIACOL 1022. • 4 adults; Department of Vaupés, Municipality of Mitú, caño Pintadillo, near the Santa Rosalía community; 01.0579°N, 070.3013°W; 190 m a.s.l.; 1 May 2013; Juan Bogotá leg.; found in the margin of a small terra firme stream; voucher CIACOL 1023.

Identification. *Moenkhausia diktyota* can be distinguished from all its congeners by the combination of a reticulated color pattern, a dark stripe extending from the caudal peduncle to the middle caudal-fin rays, and an incomplete lateral line (Lima and Toledo-Piza 2001).

Previously known distribution. Brazil: upper and middle rio Negro basin (Lima and Toledo-Piza 2001). Type locality: middle rio Negro, igarapé at São João, near Santa Isabel do rio Negro, state of Amazonas, Brazil.

Remarks. This species was expected to occur in Colombia as some of Brazilian records in the rio Tiquié (a tributary of the rio Vaupés/Uaupés) were right at the border with Colombia (FCTL pers. obs.). According to what is known about this species, it seems to be restricted to small streams from the middle and upper rio Negro drainage.

Order Characiformes
Family Characidae

***Moenkhausia gracilima* Eigenmann, 1908**
Figures 1E, 2E

New records. COLOMBIA • 1 adult; Caquetá, Municipality of Florencia, río Hacha, below the bridge on the road to Neiva; 01.5192°N, 075.2542°W; ca 260 m a.s.l.; 19 Sep. 2015; Juan Bogotá leg.; found in the rocky margin of the river; voucher CIACOL 1722. • 1 adult; Department of Putumayo, Municipality of Puerto Leguízamo, km 8 Puerto Leguízamo–La Tagua, caño El Bufeo, near San Pedro community; 00.1494°N, 074.7558°W; ca 210 m a.s.l.; 13 Mar. 2016; Iván González, Guber López, César Bonilla and Astrid Acosta leg.; found in a small stream; voucher CIACOL 1940.

Identification. The specimens were identified by the combination of presence of a faint humeral blotch and the dusky edges of the caudal fin, which are unique for this species among its congeners (e.g. Géry 1992; Lima et al. 2013).

Previously known distribution. Brazil: The species is widespread in the Amazon basin (Géry 1992; Lima et al. 2013). Type locality: Villa Bella, Serpa, Amazon River, state of Amazonas, Brazil.

Remarks. The specimens referenced herein were collected in Colombia in the Caquetá and Putumayo river drainages, both tributaries of the Amazon River and having an Andean origin. Previous occurrences in other regions of the Amazon suggest that the species is not restricted to systems with specific water chemistry. This species was already recorded from Colombia by GBIF (https://www.gbif.org/occurrence/search?country=CO&taxon_key=2352589); however, this is the first time that it is reported by a published paper.

Order Characiformes
Family Characidae

***Moenkhausia lata* Eigenmann, 1908**
Figures 1F, 2F

New records. COLOMBIA • 4 adults; Vaupés, Municipality of Mitú, río Vaupés; 01.24386°N, 070.2395°W; ca 170 m a.s.l.; 27 Aug. 2012; José Cardenas and Astrid Acosta leg.; found on a sandy beach in main channel of river; voucher CIACOL 690.

Identification. The specimens were identified by the combination of a deep body, a conspicuous humeral blotch, and a dark blotch at the upper caudal lobe (Géry 1992; Lima et al. 2013).

Previously known distribution. Brazil: the species was previously recorded from the Tapajós, Madeira, and Oyapock river basins (Géry 1992; Lima et al. 2013). Type locality: lower rio Tapajós, state of Pará, Brazil.

Remarks. The species seems to be associated with deep river channel systems. It is abundant in drainages that are part of the lower Amazon river basin in Pará, Brazil (data from MCP, UF, and ZUEC collections), but it was not previously recorded in the upper Amazon. Thus, its geographic distribution is extended by more than 2000 km. As for *M. gracilima,* our new data suggest that *M. lata* is not restricted to systems with specific water chemistry. This species was already recorded from Colombia by GBIF (https://www.gbif.org/occurrence/search?country=CO&taxon_key=2352534&advanced=1); however, this is the first time that it is reported by a published paper.

Order Characiformes
Family Characidae

***Scopaeocharax rhinodus* (Böhlke, 1958)**
Figures 1G, 2G

New records. COLOMBIA • 1 adult; Caquetá, Municipality of San José del Fragua, río San Juan, below the bridge on the road from Florencia to Belén; 01.3972°N, 075.8943°W; ca 310 m a.s.l.; 14 Aug. 2018; Juan Bogotá and Iván González leg.; voucher CIACOL 3468. • 5 adults; Department of Caquetá, Municipality of Belén, quebrada La Yuca, vía Florencia-Belén de los Andaquies; 01.6075°N, 075.6392°W; ca 280 m a.s.l.; 14 Aug. 2018; Juan Bogotá and Iván González leg.; found in the rocky margin of the river; voucher CIACOL 3469.

Identification. The specimens have the following combination of characters: premaxillary dentition composed of three irregular rows, maxillary uniserial, eight branched dorsal fin rays, adipose fin present, and seven branched pelvic-fin rays. *Scopaeocharax rhinodus* can be distinguished from its sole congener, *S. atopodus*, in presenting a more elongate body, more pointed head, and a broader midlateral stripe (Böhlke 1958: 320, fig. 1).

Previously known distribution. In Ecuador and Perú: see Ortega and Vari (1986) and Barriga (2014). Type locality: quebrada de Puente Pérez, about ¼ mile above río Huallaga, vicinity of Tingo María, Huanuco province, Perú.

Remarks. *Scopaeocharax rhinodus* is restricted to the western Amazon river basin (Ortega and Vari 1986; Carvalho et al. 2011; Barriga 2014).

Order Gymnotiformes
Family Gymnotidae

***Gymnotus tiquie* Maxime, Lima & Albert, 2011**
Figures 1H, 2H

New records. COLOMBIA • 1 adult; Vaupés, Municipality of Mitú, caño Gavilán, below waterfall at community Cucura, Mitú–Raudal Santa Cruz de Waracapurí road; 01.1659°N, 070.1476°W; ca 180 m a.s.l; 16 Sep. 2016; Joseph Waddell, Janzen Francesco, Nathan Lovejoy and William Crampton leg.; found below the waterfall from a terra firme stream; voucher CIACOL 2498.

Identification. The specimen was distinguished from its congeners by its elongated body and a color pattern composed of darkly pigmented, evenly spaced bands (typical of the subgenus *Lamontianus*), and by a wide mouth (i.e. ca 55% HL) and a short maxilla (Craig et al. 2019).

Previously known distribution. Brazil: rio Uaupés (Maxime and Albert 2011). Type locality: rio Tiquié, comunidade de São José, Igarapé Espuma, state of Amazonas, Brazil.

Remarks. Its occurrence in Colombia was expected as this species was recorded in Brazil very near the border with Colombia.

Order Siluriformes
Family Callichthyidae

***Callichthys serralabium* Lehmann & Reis, 2004**
Figures 3A, 4A

New records. COLOMBIA • 1 adult; Vaupés, Municipality of Mitú, caño Aguacatillo, tributary of the caño Yi, East from Santa Rosalía community; 01.0585°N, 070.2911°W; ca 210 m a.s.l.; 1 May 2013; Juan Bogotá leg.; found sandy in a small terra firme stream; voucher CIACOL 852.

Identification. The specimen was identified by the serrated lower lip, which is the diagnostic for the species. Other characters include the eight branched rays in the pectoral fin, long anal-fin spine, and the diffuse, blotched color pattern (Lehmann and Reis 2004).

Previously known distribution. In Brazil and Venezuela: upper río Orinoco and upper río Negro basins (Lehmann and Reis 2004). Type locality: upper río Orinoco, laguna Tonina, 1 km upstream from La Esmeralda, state of Amazonas, Venezuela (Lehmann and Reis 2004: fig. 5).

Remarks. The occurrence in Colombia was expected, as the species was recorded in Brazil, near the border with Colombia.

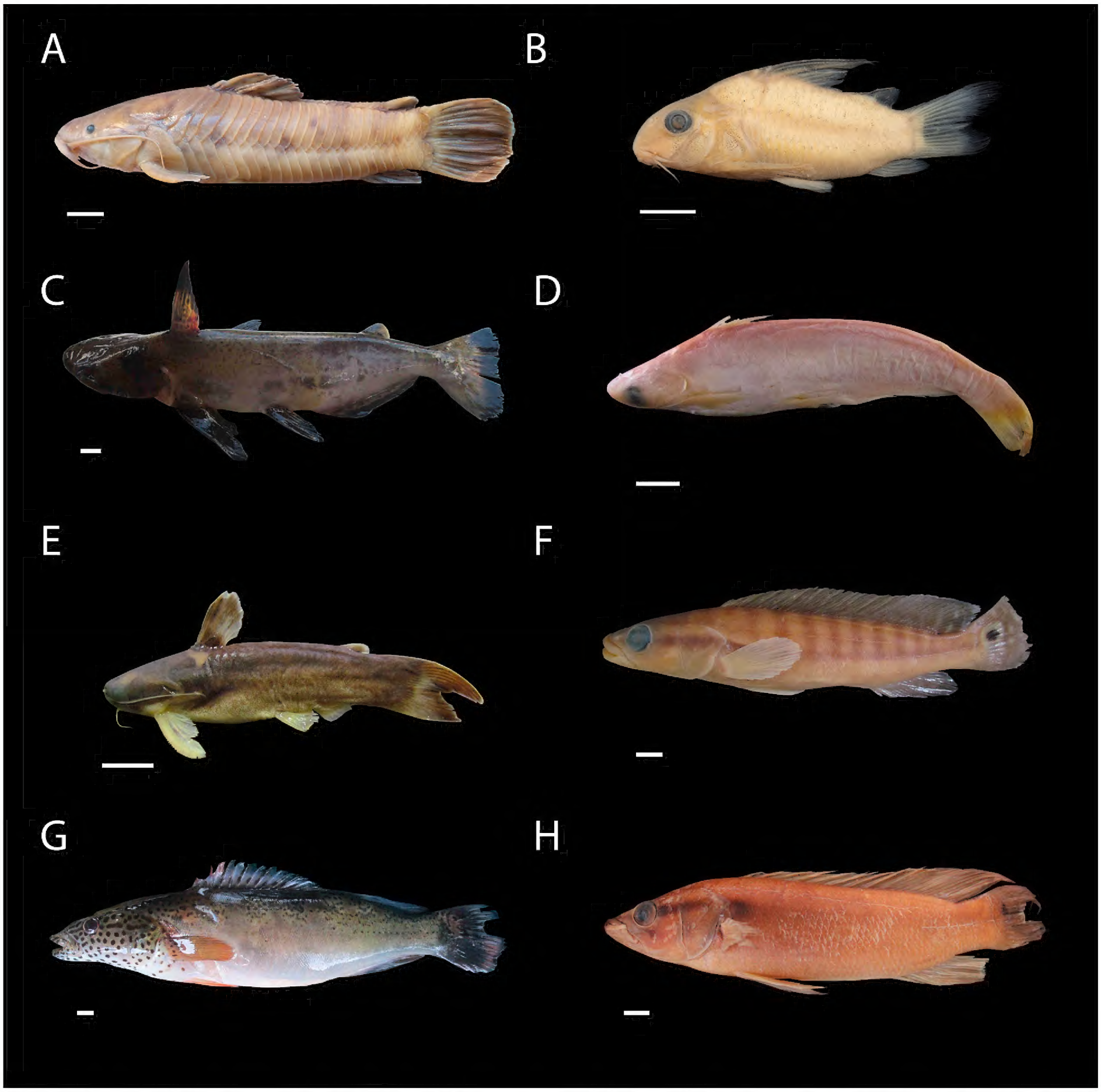

Figure 3. Siluriformes and Cichliformes. **A.** *Callichthys serralabium*. **B.** *Corydoras armatus*. **C.** *Ageneiosus polystictus*. **D.** *Auchenipterus britskii*. **E.** *Tatia brunnea*. **F.** *Crenicichla cincta*. **G.** *C. marmorata*. **H.** *C. proteus*. Scale bars = 10 mm

Order Siluriformes
Family Callichthyidae

***Corydoras armatus* (Günther, 1868)**
Figures 3B, 4B

New records. COLOMBIA • 4 adults; Amazonas, Municipality of Santa Lucía, río Cotuhé; 02.8661°S, 069.8322° W; ca 70 m a.s.l.; Francisco Villa leg; voucher CZUT-IC 14727.

Identification. The specimens were identified by the following combination of characters: compressed head, maxillary barbels extending below the eye, upper series of the shields in 23 series, strong and long fin spines with the dorsal one as long as the body depth, and the anterior shields with small black dots. The very long pectoral and dorsal spines are unique to this species (Nijssen and Isbrücker 1986).

Previously known distribution. Western Amazon basin in Brazil and Peru (Nijssen and Isbrücker 1986). Type locality: río Huallaga, Amazon drainage, Peru.

Remarks. This species was already recorded from Colombia by GBIF (https://www.gbif.org/occurrence/search?country=CO&taxon_key=2342788); however, this is the first time that it is reported by a published paper.

Order Siluriformes
Family Auchenipteridae

***Ageneiosus polystictus* Steindachner, 1915**
Figures 3C, 4C

New records. COLOMBIA • 2 adults; Vaupés, Municipality of Mitú, río Cuduyarí, vicinity of Garrafa community, mouth lago Camapí; 01.3039°N, 070.2791°W; ca 180 m a.s.l.; 20 Jul. 2012; Astrid Acosta and Leonardo

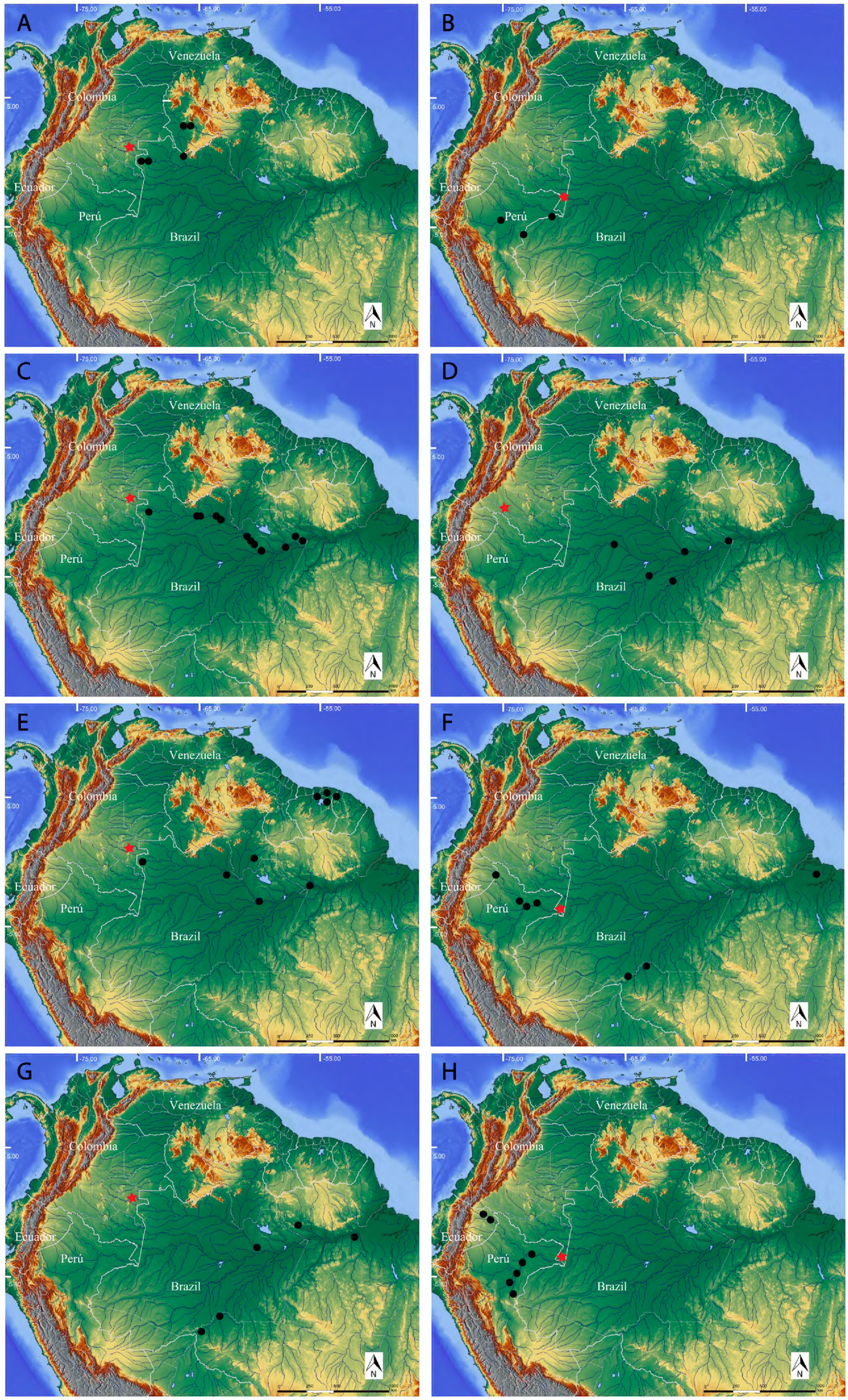

Figure 4. Localities of new records (red stars) and previous records (black circles) for Siluriformes and Cichliformes. **A.** *Callichthys serralabium*. **B.** *Corydoras armatus*. **C.** *Ageneiosus polystictus*. **D.** *Auchenipterus britskii*. **E.** *Tatia brunnea*. **F.** *Crenicichla cincta*. **G.** *C. marmorata*. **H.** *C. proteus*.

Yepez leg.; voucher CIACOL 786. COLOMBIA • 3 adults; Department of Vaupés, Municipality of Mitú río Vaupés; 01.2439°N, 070.2395°W; ca 160 m a.s.l.; 23 Nov. 2014; José Espítia and Astrid Acosta leg; voucher CIACOL 1158.

Identification. The specimens were identified by slightly emarginate caudal fin, and dark spots randomly distributed on the flanks (Ribeiro et al. 2017).

Previously known distribution. Brazil: rio Negro and middle Amazon basin (Ribeiro et al. 2017). Type locality: mouth of rio Negro, Amazon system, Brazil.

Order Siluriformes
Family Auchenipteridae

***Auchenipterus britskii* Ferraris & Vari, 1999**
Figures 3D, 4D

New records. COLOMBIA • 1 adult; Caquetá, Municipality of Solano, río Consaya; 00.5331°N, 075.1000°W; ca 200 m a.s.l.; 9 Oct. 2010; Paula Sánchez leg; voucher CIACOL 585.

Identification. The specimen was identified by the following combination of characters proposed by Ferraris and Vari (1999): mental barbels not reaching past pelvic-fin base, membrane from inner ray of pelvic fin attached to body lateral to ventral midline at the level of the anus, anal-fin origin located posterior to middle of standard length, anal-fin base length less than distance between snout and pelvic-fin origin, caudal fin without distinct dark chevron at base of upper and lower lobes, pectoral fin with 11 branched rays; pelvic fin with 12 branched rays, and a low number (34–37) of branched anal-fin rays.

Previously known distribution. Brazil: middle and western Amazon river basin (Ferraris and Vari 1999). Type locality: Lago Janauacá, vicinity of rio Solimões, ca 03.283221°S, 060.171213°W, state of Amazonas, Brazil.

Order Siluriformes
Family Auchenipteridae

***Tatia brunnea* Mees, 1974**
Figures 3E, 4E

New records. COLOMBIA • 5 adults; Vaupés, Municipality of Mitú, caño Yi, 20 m downriver from main port of Santa Rosalía community; 01.0580°N, 070.3013°W; 190 m a.s.l.; 24 Jun. 2012; Astrid Acosta and Jesús Damaso leg.; voucher CIACOL 796. • 5 adults; Department of Vaupés, Municipality of Mitú, caño Yi, near Santa Rosalía community; 01.0580°N, 070.3013°W; 190 m a.s.l.; 29 Apr. 2013; Juan Bogotá leg.; found at a small streams margin; voucher CIACOL 869. • 17 adults; Department of Vaupés, Municipality of Mitú, stream at km 8 on the road Mitú-Monfor, Ceima–San Pablo place; 1.212083 °N, 070.173583°W; ca 190 m a.s.l.; 4 May 2013; Juan Bogotá leg.; found at a small stream margin; voucher CIACOL 867.

Identification. The specimens were identified by the following combination of characters proposed by Sarmento-Soares and Martins-Pinheiro (2008): snout length 36.1–44.3% HL; eye 21.4–26.5% HL; head width 86.6–93.4% HL; mouth width 54.0–59.7% HL; postcleithral process long, 15.6–21.8% SL, almost reaching vertical through origin of dorsal fin; caudal peduncle depth greater than 13.6% SL; adult size greater than 48.0 mm SL; vomerine teeth absent; pectoral-fin spine with transverse dark bands; pectoral fin usually with one spine and five soft rays; branched anal-fin rays seven or eight; mature male genital papilla without skin flap around deferent duct; notch absent from distal margin of modified anal fin in mature males; modified anal fin in mature males with sharp distal tip, first unbranched ray divided into three or four segments, one to three short antrorse denticulations along distal anterior margin of third unbranched ray, and third anal-fin ray comparatively long, between 7.5 and 10.0% SL; border of mouth whitish, contrasting with dark head; posterior border of nuchal shield usually whitish or pale; and caudal fin usually whitish with scattered dark brown blotches.

Previously known distribution. In Brazil, French Guyana, and Suriname: Negro and Trombetas river basins (Le Bail et al. 2000; Sarmento-Soares and Martins-Pinheiro 2008). Type locality: Brokopondo district, Compagnie Kreek, Suriname.

Remarks. This species was already recorded from Colombia by GBIF (https://www.gbif.org/occurrence/search?q=Tatia%20brunnea&country=CO&taxon_key=2352534&advanced=1); however, this is the first time that it is reported by a published paper.

Order Cichliformes
Family Cichlidae

***Crenicichla cincta* Regan, 1905**
Figures 3F, 4F

New records. COLOMBIA • 1 adult; Amazonas, Municipality of Puerto Nariño, Parque Nacional Natural Amacayacu, elbow in río Amacayacu, 200 m before La Balsa; 03.8054°S, 070.3061°W; 80 m a.s.l.; 13 Oct. 2008; Camilo Fuentes, Gabriel Aricari and Gabriel Vela leg.; voucher CIACOL 435.

Identification. The specimen (CIACOL 435, Fig. 3G) was identified by the color pattern composed of 10 vertical bands on upper half of the body and a longitudinal dark stripe along the midbody. The color pattern is unique within the *Crenicichla lugubris* species group (Kullander 1986; Da Graça et al. 2013).

Previously known distribution. Amazon river basin in Brazil, Ecuador, and Peru (Kullander 1986; Da Graça et al. 2013). Type locality: Marajó Island, state of Pará, Brazil.

Order Cichliformes
Family Cichlidae

***Crenicichla marmorata* Pellegrin, 1904**
Figures 3G, 4G

New records. COLOMBIA • 3 adults; Vaupés, Municipality of Mitú, río Vaupés; 01.2439°N, 070.2395°W; ca 170 m a.s.l.; 126 Nov. 2014; José Espitia and Astrid Acosta leg; voucher CIACOL 928.

Identification. The specimens were identified by possessing ctenoid scales on flanks of the body, maxilla extending at least to the anterior margin of the eye, and color pattern composed of dark spots on head and dorsal region of the body.

Previously known distribution. Brazil: widely distributed in the Amazon river basin (Ploeg 1987; Da Graça et al. 2013). Type locality: no locality [Rio Trombetas, Amazon], state of Amazonas, Brazil.

Remarks. This species was already recorded from Colombia by GBIF (https://www.gbif.org/occurrence/search?country=CO&taxon_key=2370986); however, this is the first time that it is reported by a published paper.

Order Cichliformes
Family Cichlidae

***Crenicichla proteus* Cope, 1872**
Figures 3H, 4H

New records. COLOMBIA • 1 specimen; Amazonas, Municipality of, Leticia, Lago I, lagoon system of Yahuarcaca; 04.1933°S, 069.9531°W; ca 70 m a.s.l.; 13 Jul. 1995; Fernando Rodríguez leg.; voucher CIACOL 311. • 3 specimens (CIACOL 1362); Department of Amazonas, Municipality of, Leticia, caño de Yahuarcaca; 04.1945°S, 069.9497°W; ca 80 m a.s.l.; 13 Sep. 2014; Gabriel Aricari leg; voucher CIACOL 1362.

Identification. The species belonging to the *Crenicichla saxatilis*-group, are characterized by the relatively large scales and consequently lower scales counts, and the presence of a humeral blotch. Among the *Crenicichla* species of the *C. saxatilis* group occurring in the western Amazon Basin, it is distinguished primarily by the low scale counts, a dusky notch below the eye, and the humeral blotch below the lateral line (Kullander 1986; Varella et al. 2018)

Previously known distribution. Amazon river basin in Brazil, Ecuador, and Peru (Kullander 1986). Previous records of *Crenicichla saxatilis* from Colombian Amazon (e.g., Galvis et al. 2006) likely belong to this species. Type locality: río Ambyiacu, Peru.

Discussion

The Neotropical region is well recognized as a primary source of biodiversity (Antonelli et al. 2018), and specifically, it has the most species-rich freshwater ichthyofauna on Earth (Albert and Reis 2011; Reis et al. 2016). However, a comprehensive understanding of how species are distributed among its aquatic ecosystems still far off (Oberdorff et al. 2019). Much of what is known about the fishes of the Neotropical region is based on the material deposited in the collections. Scientific reference collections are essential for documenting biodiversity. Our new data contribute to a general understanding of how species are spatially distributed, which is fundamental for understanding historical drivers of species diversity of this megadiverse fauna (Oberdorff et al. 2019).

The relatively large number of species newly recorded from Colombia may reflect the general lack of ichthyological studies that have been done in the Colombian Amazon. Vast areas of the Colombian Amazon are still unexplored, especially in remote, almost inaccessible areas, where a meaningful approximation of the actual species richness is still not possible. However, some of the species that we report, such as *Gymnotus tiquie* and *Ageneiosus polystictus*, were expected to be in Colombian territory, as they were known to occur in the same river systems in adjacent countries. Additional ichthyological studies in the Colombian Amazon are important to improve our understanding of fish distributions there.

Scientific collections like those investigated here are fundamental for understanding patterns of biodiversity (Arbeláez-Cortés et al. 2017), as well as other collections-based research; however, the scientific importance of collections it is not always well appreciated (Carvalho et al. 2008), and most collections face long-term support and maintenance issues (Poss and Collette 2008). With improved support, the deposition, curation, and maintenance of specimens should improve, and those improvements will ultimately allow for reliable information to be available and used in various research areas such as taxonomy, systematics, ecology, and biogeography.

Natural ecosystems in the Neotropics are increasingly threatened by habitat loss (e.g. deforestation, mining, and hydroelectric dam construction) and degradation (e.g. climate change). Management and conservation plans are still lacking (Abell et al. 2008; Reis et al. 2016; Machado-Allison 2017). Our new records will complement baseline data for a general understanding of the origin and maintenance of the largest vertebrate non-marine assemblage, and how it can be protected.

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Authors' Contributions

JDBG, AAC, FAVN, and EAC collected specimens; JDBG, FCTL, CD, AAC, and FAVN identified the specimens; JDBG, FCTL, and CD wrote the manuscript.

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